CLAIMS

WHAT IS CLAIMED IS:

1. A thermally enhanced Plastic Ball Grid Array (PBGA) package comprising a heat sink for mounting over a surface of a substrate of the thermally enhanced Plastic Ball Grid Array (PBGA) package, said heat sink comprising: (a) a horizontal section being parallel with a substrate over which said heat spreader is being mounted, said horizontal section having a perimeter; (b) heat spreader stand-off sections extending from said perimeter of said horizontal section, a lower section of said heat spreader stand-off sections forming a physical interface between said heat spreader and said substrate over which said heat spreader is being mounted; (c) each of said heat spreader standoff sections comprising: (i) an upper section being connected with said horizontal section of said heat spreader under an angle (ii) a center section being connected with said upper section in a plane of said upper section, and (iii) said lower section being connected with said center section of said heat spreader standoff section; (d) each lower section of each of said heat spreader standoff sections comprising: (i) a first horizontal section being parallel with the surface of said substrate, said first horizontal section being connected with said lower section of said heat spreader stand-off section; (ii) a U-shaped extrusion connected with said first horizontal section, with a lower side of said U-shaped extrusion facing said substrate, with two retaining sides of said U-shaped extrusion interfacing with the surface of said substrate under an angle, with at least one opening having been created through said lower side of said U-shaped extrusion; and (iii) a second horizontal section connected to said U-shaped extrusion.

2. The thermally enhanced Plastic Ball Grid Array (PBGA) package of claim 1, additionally comprising: a substrate having a first and a second surface, at least one metal pad having been provided over the second surface of said substrate, additionally at least one semiconductor device having been mounted and interconnected over said second surface of said substrate; said heat spreader having been positioned over said second surface of said substrate; said at least one metal pad having been aligned with said at least one opening created through said lower side of said U-shaped extrusion; said at least one metal pad having been inserted into said at least one opening created through said lower side of said U-shaped extrusion; and at least one supply of thermally conductive epoxy having been provided over the surface of said at least one metal pad, thereby at least overlying said lower side of said U-shaped extrusion with a layer of said thermally conductive epoxy.

3. The method of claim 2, said at least one metal pad comprising copper.

4. The thermally enhanced Plastic Ball Grid Array (PBGA) package of claim 1, additionally comprising: a substrate having a first and a second surface, at least one metal pad having been provided over the second surface of said substrate, said at least one metal pad having been provided with a stud bump over the surface thereof, additionally at least one semiconductor device having been mounted and interconnected over said second surface of said substrate; said heat spreader having been positioned over said second surface of said substrate; said stud bump provided over the surface of said at least one metal pad having been aligned with said at least one opening created through said lower side of said U-shaped extrusion; said at least one stud bump having been inserted into said at least one opening created through said lower side of said U-shaped extrusion; and at least one supply of thermally conductive epoxy or solder paste having been provided over the surface of said stud bump provided over said at least one metal pad, thereby overlying said stud bump and further at least overlying said lower side of said U-shaped extrusion with a layer of said thermally conductive epoxy or solder paste.

5. The structure of claim 4, said at least one metal pad comprising copper.

6. The structure of claim 4, said stud bump comprising gold.

7. The thermally enhanced Plastic Ball Grid Array (PBGA) package of claim 1, additionally comprising: a substrate having a first and a second surface, at least one metal pad having been provided over the second surface of said substrate, said at least one metal pad having been provided with a solder ball over the surface thereof, additionally at least one semiconductor device having been mounted and interconnected over said second surface of said substrate; said heat spreader positioned over said second surface of said substrate; said solder bump provided over said at least one metal pad having been aligned with said at least one opening created through said lower side of said U-shaped extrusion; and said solder bump having been inserted into said at least one opening created through said lower side of said U-shaped extrusion.

8. The structure of claim 7, said metal pad comprising copper.

9. A thermally enhanced Plastic Ball Grid Array (PBGA) package comprising a heat sink for mounting over a surface of a substrate of the thermally enhanced Plastic Ball Grid Array (PBGA) package, said heat sink comprising: (a) a horizontal section being parallel with a substrate over which said heat spreader is being mounted, said horizontal

section having extremities around a perimeter thereof; (b) heat spreader stand-off sections extending from said perimeter of said horizontal section, a second horizontal section of a lower section of said heat spreader stand-off sections forming a physical interface between said heat spreader and said substrate; (c) each of said heat spreader standoff sections comprising: (i) an upper section being connected to said horizontal section of said heat spreader under an angle; (ii) a first center section being connected with said upper section of said heat spreader standoff section in a plane of said upper section; (iii) a lower section being connected with said first center section of said heat spreader stand-off section, said lower section comprising: (1) a first horizontal section connected with said lower section of said heat spreader stand-off section, said first horizontal section being parallel with the surface of said (2) a second center section intersecting connected with said first horizontal section, said second center section intersecting the surface of said substrate under an angle; (3) said second horizontal section connected to said second center section; and (4) an essentially spherically shaped supportive metal interface between said first horizontal section of said lower section of said heat spreader stand-off section and the surface of said substrate as a physical extension of said first horizontal section.

10. The thermally enhanced Plastic Ball Grid Array (PBGA) package of claim 4, additionally comprising: a substrate having a first and a second surface, at least one metal pad having been provided over the second surface of said substrate, additionally at least one semiconductor device having been mounted and interconnected over said second surface of said substrate; said heat spreader positioned over said second surface of said substrate; said at least one metal pad having been aligned with said second horizontal section of said lower section thereby positioning said second horizontal section of said lower section over said at least one metal pad by a first measurable amount, exposing the surface of said at least one metal pad by a second measurable amount; and providing at least one supply of thermally conductive epoxy over the surface of said second horizontal section of said lower section, thereby including the exposed surface of said at least one metal pad provided in a second surface of said substrate.

11. The structure of claim 10, said at least one metal pad comprising copper.

12. A method for packaging a semiconductor device, forming a Plastic Ball Grid Array (PBGA) package, comprising the steps of: (A) providing a semiconductor device mounting support having a first and a second surface, said semiconductor device mounting

support having been provided with interconnect traces and at least one metal pad therein or thereover; (B) mounting at least one semiconductor device over the second surface of said semiconductor device mounting support; (C) connecting said at least one semiconductor device in a face upward position by facing an active surface of said at least one semiconductor device away from said semiconductor device mounting support, using interconnect wires between said interconnect traces provided in said semiconductor device mounting support and contact points provided in an active surface of said at least one semiconductor device; (D) positioning a heat spreader over the surface of said substrate, said heat spreader comprising: (a) a horizontal section being parallel with a semiconductor device mounting support over which said heat spreader is being mounted, said horizontal section having a (b) heat spreader standoff sections extending from said perimeter of said horizontal section, a lower section of said heat spreader stand-off sections forming a physical interface between said heat spreader and said semiconductor device mounting support over which said heat spreader is being mounted; (c) each of said heat spreader standoff sections comprising: (i) an upper section being connected to said horizontal section of said heat spreader under an angle (ii) a center section being connected with said upper section in a plane of said upper section, and (iii) said lower section being connected with said center section of said heat spreader standoff section; (d) each lower section of each of said heat spreader standoff sections comprising: (i) a first horizontal section being parallel with the surface of said semiconductor device mounting support, said first horizontal section being connected with said lower section of said heat spreader stand-off section; (ii) a U-shaped extrusion connected with said first horizontal section, with a lower side of said U-shaped extrusion facing said semiconductor device mounting support, with two remaining sides of said U-shaped extrusion interfacing with the surface of said semiconductor device mounting support under an angle, with at least one opening having been created through said lower side of said U-shaped extrusion; and (iii) a second horizontal section connected to said U-shaped extrusion; and (E) having mounted and interconnected at least one semiconductor device, further creating a mold compound overlying at least part of said heat spreader.

13. The method of claim 12, additionally curing said mold compound and said thermally conductive epoxy.

14. The method of claim 12, said heat spreader comprising metal.

15. The method of claim 12, said heat spreader comprising thermally conductive epoxy.

16. The method of claim 12, in addition providing end-of-line processing for said packaging of said semiconductor device, said end-of-line processing comprising steps of connecting contact balls to the first surface of said semiconductor device mounting support, completing creation of a thermally enhanced Plastic Ball Grid Array (PBGA) package.

17. The method of claim 12, additionally comprising the steps of: aligning said at least one metal pad with said at least one opening created through said lower side of said U-shaped extrusion; inserting said at least one metal pad having into said at least one opening created through said lower side of said U-shaped extrusion; and supplying thermally conductive epoxy over the surface of said at least one metal pad, thereby at least overlying said lower side of said U-shaped extrusion with a layer of said thermally conductive epoxy.

18. The method of claim 12, said at least one metal pad comprising copper.

19. The method of claim 12, said at least one metal pad serving as ground pad.

20. A method for packaging a semiconductor device, forming a Plastic Ball Grid Array (PBGA) package, comprising the steps of: (A) providing a semiconductor device mounting support having a first and a second surface, said semiconductor device mounting support having been provided with interconnect traces and at least one metal pad therein or thereover, a stud bump having been provided over the surface of said at least one metal pad; (B) mounting at least one semiconductor device over the second surface of said semiconductor device mounting support; (C) connecting said at least one semiconductor device in a face upward position by facing an active surface of said at least one semiconductor device away from said semiconductor device mounting support, using interconnect wires between said interconnect traces provided in said semiconductor device mounting support and contact points provided in an active surface of said at least one semiconductor device; (D) positioning a heat spreader over the surface of said semiconductor mounting support, said heat spreader comprising: (a) a horizontal section being parallel with a semiconductor device mounting support over which said heat spreader is being mounted, said horizontal section having a (b) heat spreader stand-off sections extending from said perimeter of said horizontal section, a lower section of said heat spreader stand-off sections forming a physical interface between said heat spreader and said semiconductor device mounting support over which said heat spreader is being mounted; (c) each of said heat

spreader standoff sections comprising: (i) an upper section being connected to said horizontal section of said heat spreader under an angle (ii) a center section being connected with said upper section in a plane of said upper section, and (iii) said lower section being connected with said center section of said heat spreader standoff section; (d) each lower section of each of said heat spreader standoff sections comprising: (i) a first horizontal section being parallel with the surface of said semiconductor device mounting support, said first horizontal section being connected with said lower section of said heat spreader stand-off section; (ii) a U-shaped extrusion connected with said first horizontal section, with a lower side of said U-shaped extrusion facing said semiconductor device mounting support, with two remaining sides of said U-shaped extrusion interfacing with the surface of said semiconductor device mounting support under an angle, with at least one opening having been created through said lower side of said U-shaped extrusion; and (iii) a second horizontal section connected to said U-shaped extrusion; and (E) mounting and interconnecting at least one semiconductor device, further creating mold compound overlying at least part of said heat spreader.

21. The method of claim 20, additionally curing said mold compound and said thermally conductive epoxy.

22. The method of claim 20, said heat spreader comprising metal.

23. The method of claim 20, said heat spreader comprising thermally conductive epoxy.

24. The method of claim 20, in addition providing end-of-line processing for said packaging of said semiconductor device, said end-of-line processing comprising steps of connecting contact balls to the first surface of said semiconductor device mounting support, completing creation of a thermally enhanced Plastic Ball Grid Array (PBGA) package.

25. The method of claim 20, additionally comprising the steps of: aligning said stud bump provided over the surface of said at least one metal pad with said at least one opening created through said lower side of said U-shaped extrusion; inserting said at least one stud bump into said at least one opening created through said lower side of said U-shaped extrusion; and supplying thermally conductive epoxy or solder paste over the surface of said at least one metal pad, thereby at least overlying said stud bump and further at least overlying said lower side of said U-shaped extrusion with a layer of said thermally conductive epoxy or solder paste.

26. The method of claim 20, said at least one metal pad comprising copper.

27. The method of claim 20, said at least one metal pad serving as ground pad.

28. The method of claim 20, said stud bump comprising gold.

29. A method for packaging a semiconductor device, forming a Plastic Ball Grid Array (PBGA) package, comprising the steps of: (A) providing a semiconductor device mounting support having a first and a second surface, said semiconductor device mounting support having been provided with interconnect traces and at least one metal pad therein or thereover, a solder bump having been provided over the surface of said at least one metal (B) mounting at least one semiconductor device over the second surface of said semiconductor device mounting support; (C) connecting said at least one semiconductor device in a face upward position by facing an active surface of said at least one semiconductor device away from said semiconductor device mounting support, using interconnect wires between said interconnect traces provided in said semiconductor device mounting support and contact points provided in an active surface of said at least one semiconductor device; (D) positioning a heat spreader over the surface of said semiconductor mounting support, said heat spreader comprising: (a) a horizontal section being parallel with a semiconductor device mounting support over which said heat spreader is being mounted, said horizontal section having a perimeter; (b) heat spreader stand-off sections extending from said perimeter of said horizontal section, a lower section of said heat spreader stand-off sections forming a physical interface between said heat spreader and said semiconductor device mounting support over which said heat spreader is being mounted; (c) each of said heat spreader standoff sections comprising: (i) an upper section being connected to said horizontal section of said heat spreader under an angle (ii) a center section being connected with said upper section in a plane of said upper section, and (iii) said lower section being connected with said center section of said heat spreader standoff section; (d) each lower section of each of said heat spreader standoff sections comprising: (i) a first horizontal section being parallel with the surface of said semiconductor device mounting support, said first horizontal section being connected with said lower section of said heat spreader stand-off section; (ii) a U-shaped extrusion connected with said first horizontal section, with a lower side of said U-shaped extrusion facing said semiconductor device mounting support, with two remaining sides of said U-shaped extrusion interfacing with the surface of said semiconductor device mounting support under an angle, with at least one opening having been created through said lower side

of said U-shaped extrusion; and (iii) a second horizontal section connected to said U-shaped extrusion; and (E) mounting and interconnecting at least one semiconductor device, further creating mold compound overlying at least part of said heat spreader.

30. The method of claim 29, additionally curing said mold compound and said thermally conductive epoxy.

31. The method of claim 29, said heat spreader comprising metal.

32. The method of claim 29, said heat spreader comprising thermally conductive epoxy.

33. The method of claim 29, in addition providing end-of-line processing for said packaging of said semiconductor device, said end-of-line processing comprising steps of connecting contact balls to the first surface of said semiconductor device mounting support, completing creation of a thermally enhanced Plastic Ball Grid Array (PBGA) package.

34. The method of claim 29, additionally comprising the steps of: aligning said solder bump provided over the surface of said at least one metal pad with said at least one opening created through said lower side of said U-shaped extrusion; and inserting said at least one solder bump into said at least one opening created through said lower side of said U-shaped extrusion.

35. The method of claim 29, said at least one metal pad comprising copper.

36. The method of claim 29, said at least one metal pad serving as ground pad.

37. A method for packaging a semiconductor device, forming a Plastic Ball Grid Array (PBGA) package, comprising the steps of: (A) providing a semiconductor device mounting support having a first and a second surface, said semiconductor device mounting support having been provided with interconnect traces and at least one metal pad therein or thereover, a solder bump having been provided over the surface of said at least one metal pad; (B) mounting at least one semiconductor device over the second surface of said semiconductor device mounting support; (C) connecting said at least one semiconductor device in a face upward position by facing an active surface of said at least one semiconductor device away from said semiconductor device mounting support, using interconnect wires between said interconnect traces provided in said semiconductor device mounting support and contact points provided in an active surface of said at least one semiconductor device; (D) positioning a heat spreader over the surface of said semiconductor

device mounting support, said heat spreader comprising: (a) a horizontal section being parallel with a semiconductor device mounting support over which said heat spreader is being mounted, said horizontal section having extremities around a perimeter thereof; (b) heat spreader stand-off sections extending from said perimeter of said horizontal section, a second horizontal section of a lower section of said heat spreader stand-off sections forming a physical interface between said heat spreader and said semiconductor device mounting support; (c) each of said heat spreader standoff sections comprising: (i) an upper section being connected to said horizontal section of said heat spreader under an angle; (ii) a first center section being connected with said upper section of said heat spreader standoff section in a plane of said upper section; (iii) a lower section being connected with said first center section of said heat spreader stand-off section, said lower section comprising: (1) a first horizontal section connected with said lower section, said first horizontal section being parallel with the surface of said semiconductor device mounting support; (2) a second center section intersecting connected with said first horizontal section, said second center section intersecting the surface of said semiconductor device mounting support under an angle; (3) said second horizontal section connected to said second center section; and (4) an essentially spherically shaped supportive metal interface between said first horizontal section of said lower section of said heat spreader stand-off section and the surface of said semiconductor device mounting support as a physical extension of said first horizontal section; and (E) mounting and interconnecting at least one semiconductor device, further creating mold compound overlying at least part of said heat spreader.

38. The method of claim 37, additionally curing said mold compound and said thermally conductive epoxy.

39. The method of claim 37, said heat spreader comprising metal.

40. The method of claim 37, said heat spreader comprising thermally conductive epoxy.

41. The method of claim 37, in addition providing end-of-line processing for said packaging of said semiconductor device, said end-of-line processing comprising steps of connecting contact balls to the first surface of said semiconductor device mounting support, completing creation of a thermally enhanced Plastic Ball Grid Array (PBGA) package.

42. The method of claim 37, additionally comprising the steps aligning said at least one metal pad with said second horizontal section of said lower section thereby positioning said second horizontal section of said lower section over said at least one metal pad by a first measurable amount, exposing the surface of said at least one metal pad by a second measurable amount; and providing at least one supply of thermally conductive epoxy over the surface of said second horizontal section of said lower section, thereby including the exposed surface of said at least one metal pad provided in a second surface of said semiconductor device mounting support.

43. The method of claim 37, said at least one metal pad comprising copper.

44. The method of claim 37, said at least one metal pad serving as ground pad.

45. The structure of claim 4, said stud bump comprising copper.

46. The method of claim 20, said heat spreader comprising solder

47. The method of claim 20, said stud bump comprising copper.

48. The method of claim 29, said heat spreader comprising solder